

ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF COMMERCIAL FISHERIES

NORTON SOUND AREA
SHELLFISH REPORT
to the
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Table of Contents

<u>Section</u>	<u>Page</u>
List of Tables.....	i
List of Figures.....	ii
Abstract.....	iii
Introduction.....	1
Commercial Fishery.....	3
Subsistence Fishery.....	7
Stock Status.....	11
Outlook for 1986.....	17
Management Strategy.....	19

List of Tables

	<u>Page</u>
Table 1: Winter commercial and subsistence red king crab harvests, Norton Sound, 1978-85.....	4
Table 2: Commercial harvest of red king crabs in Norton Sound, summer fishery, 1977-85.....	8
Table 3: Winter 1984-85 subsistence red king catches and effort by gear type, Norton Sound.....	10
Table 4: Catch of red king crabs in Norton Sound during research surveys and resulting population estimates, 1976-1985.....	12
Table 5: Percent recruit size crab for the Norton Sound male red king crab population from commercial catch samples.....	15
Table 6: Population estimate for Norton Sound male red king crab.....	18

List of Figures

	<u>Page</u>
Figure 1: King crab fishing districts and sections of statistical Area Q.....	2
Figure 2: Comparison of mean catch of legal male red king crab per pot from ADF&G pot surveys and resulting population estimates, Norton Sound, 1980-1982, 1985.....	5
Figure 3: Statistical areas for the Norton Sound red king crab fishery.....	6
Figure 4: Size structure of the male red king crab population, Norton Sound, Alaska as determined by research fishing, NMFS.....	13
Figure 5: Size structure of the male red king crab population, Norton Sound, Alaska as determined by research fishing, ADF&G, 1980-1982.....	14
Figure 6: Size structure of the 1985 Norton Sound male red king crab population from assessment surveys conducted by ADF&G and NMFS.....	16
Figure 7: Red king crab catch samples for the Norton Sound summer fishery, 1978-1985.....	20

ABSTRACT

Summaries of the commercial and subsistence red king crab (Paralithodes camtschatica) fisheries are presented. The methods used to derive the 1985 population estimates by both ADF&G and NMFS are discussed within the section describing recent research in Norton Sound. The 1986 summer harvest goal is set at 427,000 or at 15% of the estimated legal population. The final section justifies the current exploitation level.

Introduction

The Norton Sound section of the Northern District in Area Q is described in the shellfish regulations as all waters east of 168 degrees W. long., between the latitudes of Cape Romanzof and Cape Prince of Wales (Figure 1). The only shellfish fishery in Norton Sound is for red king crab (Paralithodes camtschatica). Blue king crab (P. platypus) and tanner crab (Chionoecetes opilio) also occur within the section but are very seldom caught by commercial or subsistence fishermen. Red king crab have been utilized for subsistence purposes by local residents for many years, but the commercial fishery was not initiated until nine years ago. In April 1977, the Alaska Board of Fisheries opened an "exploratory" commercial fishery in order to increase the knowledge and commercial utilization of Norton Sound king crab. Since 1976 there have been four National Marine Fisheries Service (NMFS) research trawl studies in Norton Sound as well as four Alaska Department of Fish and Game (ADF&G) research pot fishing studies. Data from these studies, from winter research studies, and from nine commercial fishing seasons have greatly increased our knowledge of the Norton Sound king crab.

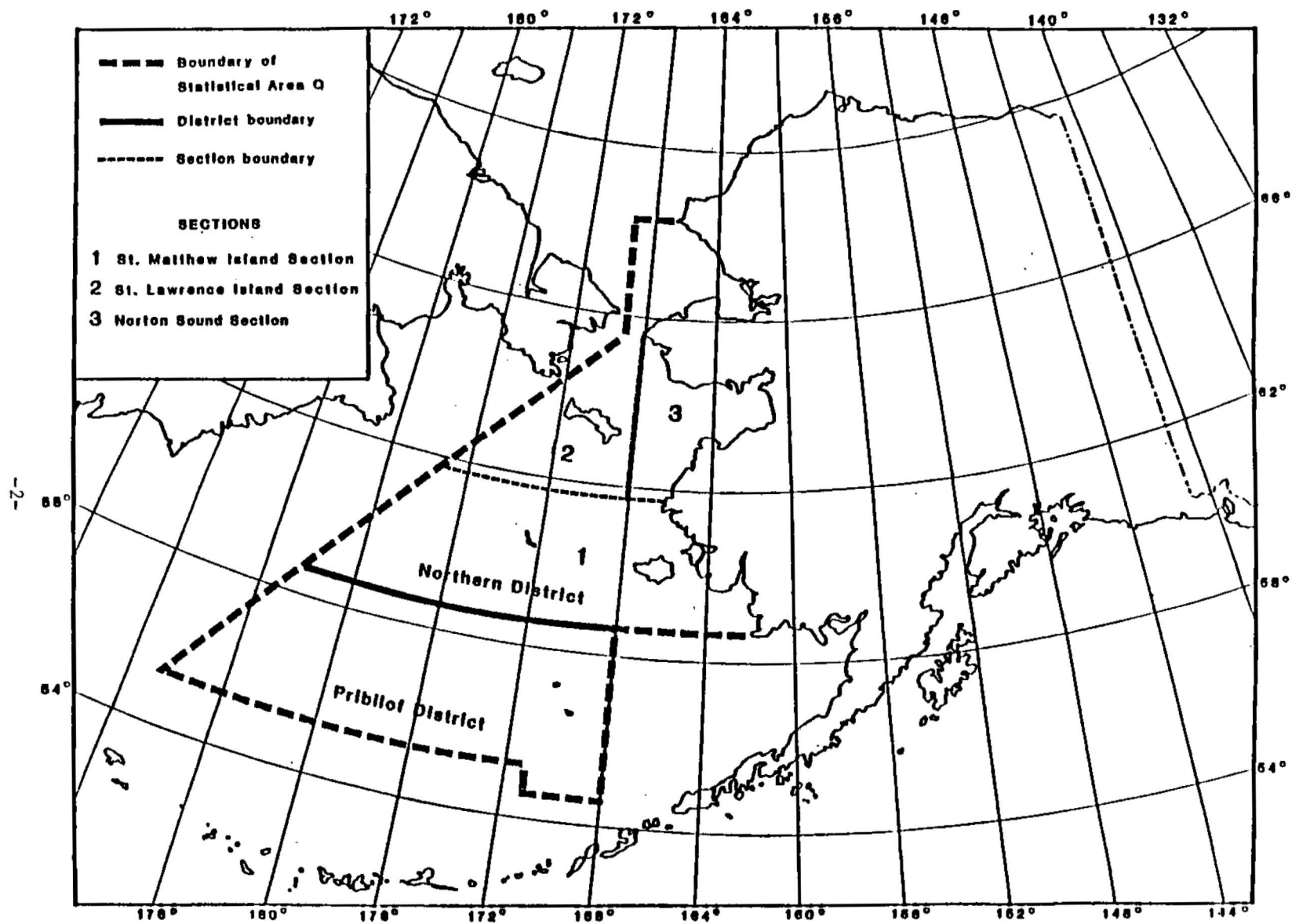


Figure 1. King crab fishing districts and sections of Statistical Area Q

Commercial Fishery

There are two seasons in which crab may be taken commercially: November 15-May 15 and August 1-September 3. During the winter season crab are taken through the ice near Nome. In 1985 nine winter commercial fishermen reported a harvest of 1,168 crab. Fishing effort usually occurs within 5 miles of the town of Nome. The average price was \$5.56 per crab. Weights on crab were not taken (Table 1).

Prior to the start of the 1985 summer commercial fishery the legal male population was estimated to be 3.0 million pounds (approximately 0.9 million crab), including about 44% recruit crab. This estimate was based on a comparison of the mean catch per pot and subsequent population estimates from previous ADF&G pot surveys (1980-1982) (Figure 2). A harvest strategy was adopted by the Board of Fisheries in 1981 (5AAC 34.915) which set the optimum yield (O.Y.) in Norton Sound at 1/2 the normal exploitation rate as determined in 5AAC 34.080, to provide protection to a long established subsistence fishery. Under harvest strategy guidelines set forth in 5AAC 34.080, the status of the 1985 male king crab population in Norton Sound was judged to be depressed, with a stable abundance of prerecruits and a moderate level of postrecruitment. The appropriate level of exploitation was set at 30% under these conditions, but was reduced to 15% in Norton Sound, which allowed a harvest of approximately 450,000 pounds. An additional regulation intended to protect the subsistence fishery is a nearshore closure to summer commercial fishermen (Figure 3).

The Norton Sound commercial red king crab fishery opened by regulation at noon, August 1. Tank inspections and registrations were conducted beginning noon July 31; tank inspection stickers were delivered to all registered vessels by 10:00 a.m. of August 1. Six fishing vessels participated in the fishery, two of which were catcher processors. The average vessel brought 186 pots to fish in Norton Sound. In addition to these fishing vessels, a floating processor was on the grounds to buy crab from the fishermen. The season lasted 21.7 days and was closed by emergency order at 8:00 a.m., August 23 when it was anticipated a harvest of 450,000 pounds would be reached.

By August 7 approximately 68,000 pounds had been harvested with an average catch per pot of just 6 crab. This harvest represented roughly 1/7 of the harvest goal. At this rate it was projected the O.Y. of 15% of the legal male crab population would not occur before the season closed on September 3. In an attempt to achieve the O.Y. and comply

Table 1 . Winter commercial and subsistence red king crab harvests, Norton Sound 1978-1985. 1/

Commercial			Subsistence						
Year 2/	Fisher- men	# Crab Harvested	Winter 3/	Permits Issued	Permits Returned	Permits Fished	Total Crab Caught 4/	Total Crab Harvested 5/	Average Harvest/fm
1978	37	9,625	1977-78	290	206	149	6/	12,506	84
1979	1	221	1978-79	48	43	38	6/	224	6
1980	1	22	1979-80	22	14	9	6/	213	24
1981	0	0	1980-81	51	39	23	6/	360	16
1982	1	17	1981-82	101	76	54	6/	1,288	24
1983	5	549	1982-83	172	106	85	6/	10,432	123
1984	8	856	1983-84	222	183	143	15,923	11,220	78
1985	9	1,168	1984-85	203	166	132	10,757	8,377	63

1/ 1977-1984 represents finalized data; 1985 data is preliminary.

2/ Prior to 1985 the winter commercial fishery occurred from January 1-April 30; as of March 1985, the winter commercial harvest may occur from November 15-May 15.

3/ The winter subsistence fishery occurs during months of two calendar years (as early as December through May).

4/ The number of crab actually caught; some may have been returned.

5/ The number of crab "harvested" is the number of crab caught and kept.

6/ Data unavailable.

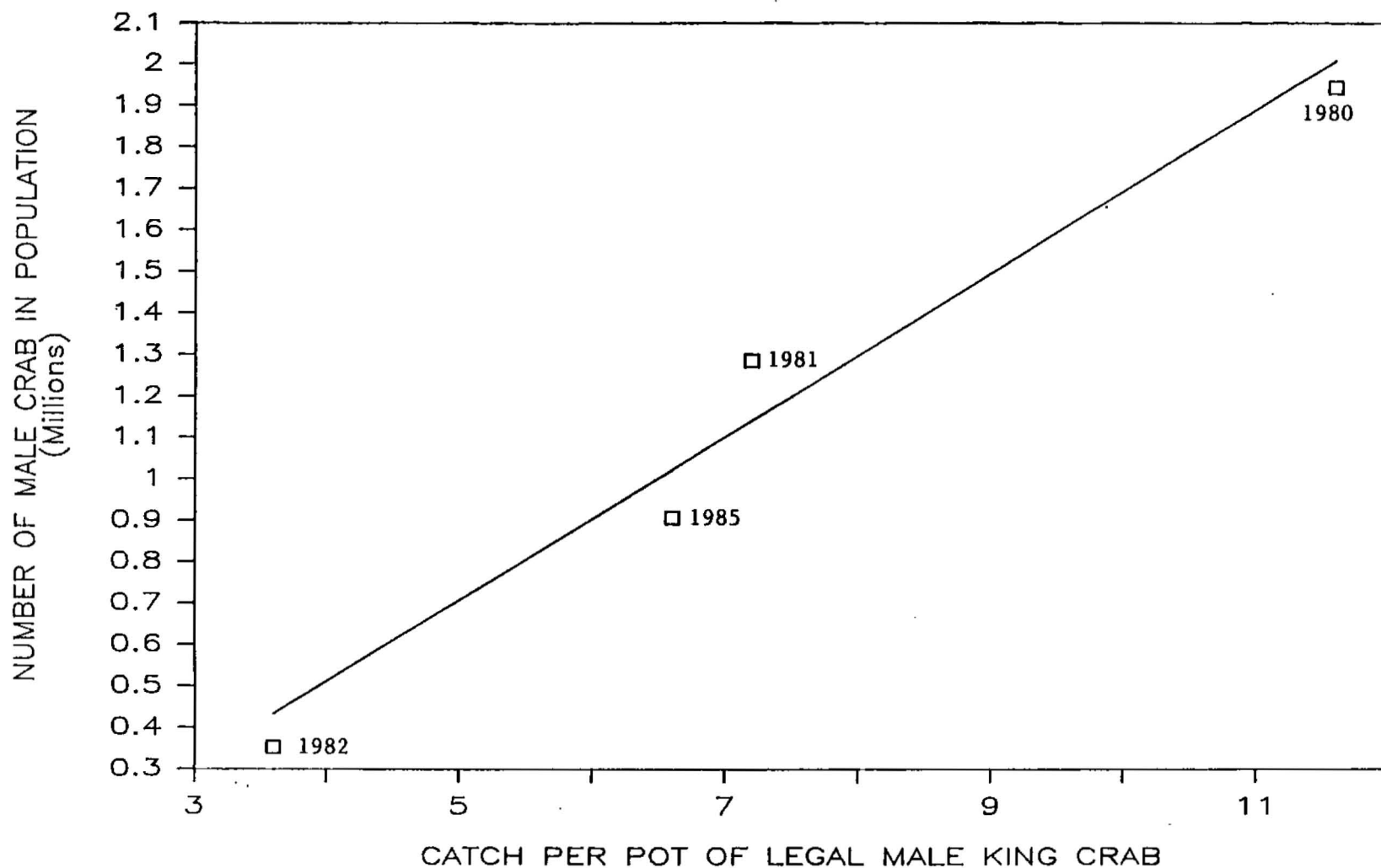


Figure 2. Comparison of mean catch of legal male red king crab per pot from ADF&G pot surveys and resulting population estimates, Norton Sound, 1980-1982, 1985.

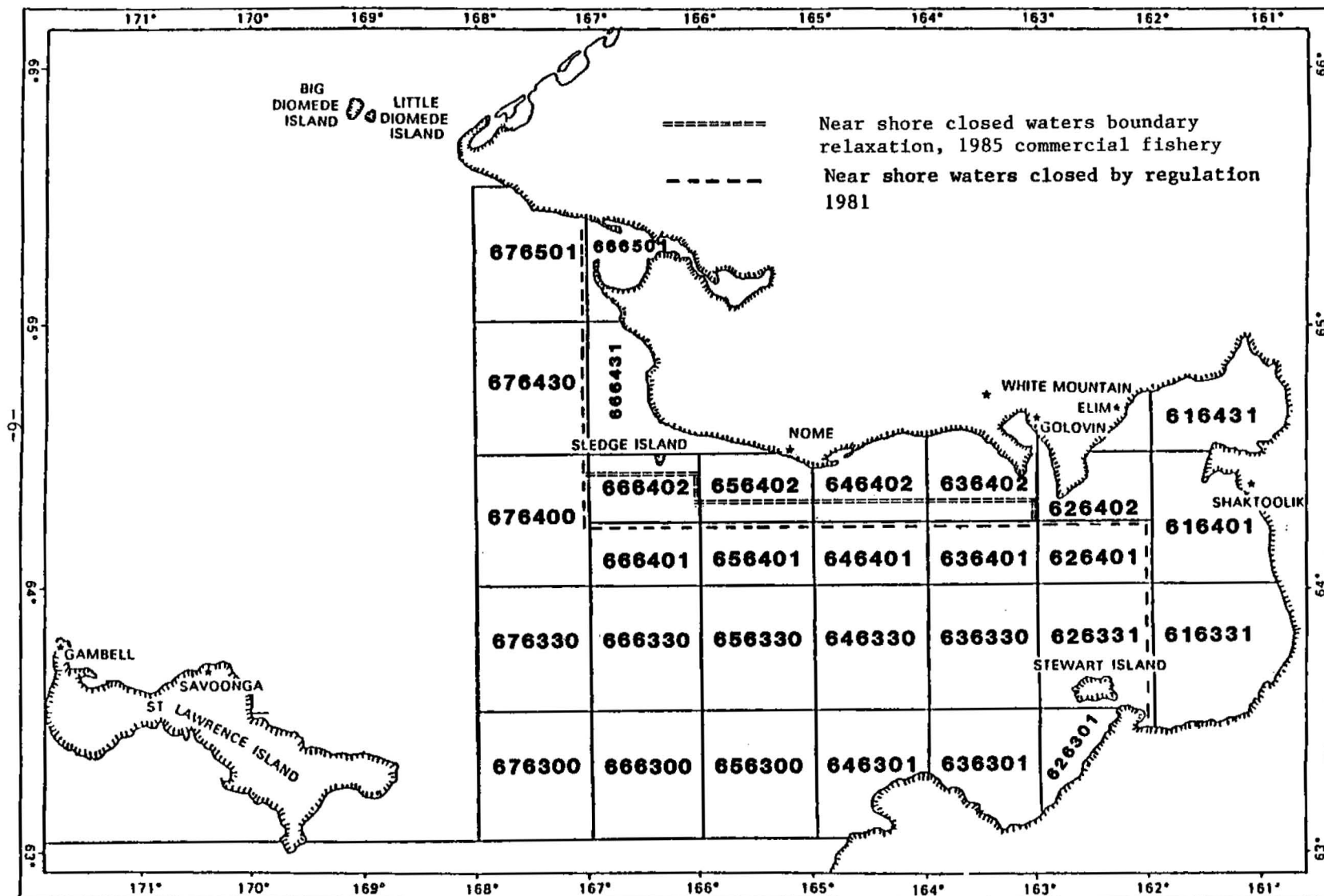


Figure 3. Statistical areas for the Norton Sound red king crab fishery.

with the regulatory closure date, approximately one third of the closed water section was opened to commercial crab fishing on August 7 (Figure 3). Due to the late breakup, the bulk of the king crab population had not migrated beyond the closed waters area. The abundance of the nearshore king crab distribution was documented during the July ADF&G pot survey charter. The intent of this regulation change was to make more crab available to the commercial crab fleet while still protecting the crab present on the winter fishing grounds. As fishing continued, the average catch per pot rose from 6 to 11 crab and remained at this level until the fishery was closed on August 23.

The final harvest was 427,011 pounds with approximately 39% of the harvest (166,000 pounds) caught in the normally closed area. The average weight per crab was 2.9 pounds. The average catch per pot lift was 11 legal crab. The fishermen received \$1.00 per pound, with the entire fishery thus worth approximately \$427,000.00 to the fishermen. The average fisherman earned nearly \$72,000.00.

Approximately 4,152 pounds of deadloss was reported or observed; this problem due to fresh water poisoning was spotted early on in the fishery and was corrected by frequent deliveries to the processor, and by holding the crab for a short period of time in brine tanks onboard the processor.

After the 1985 fishery, another estimate of the legal male crab population was made using tagged crab recovered in the fishery. An estimate of 2.4 million pounds of legal crab prior to the start of the fishery was derived. This estimate was lower than the preseason estimate of 3.0 million pounds. Using the post season estimate, the 1985 commercial harvest represented an 18% exploitation of the legal male population (Table 2).

Subsistence Fishery

Red king crab are utilized by Norton Sound residents mainly during the winter. Fishing occurs through holes or cracks in the ice with the use of handlines and pots.

In order to document trends in the subsistence harvest, the Board of Fisheries enacted a regulation in 1977 requiring subsistence fishermen in Norton Sound to obtain a permit prior to fishing and record daily effort and catches on these permits. Catches are presented in Tables 1 and 3. After the first commercial harvest of about one half million pounds in the summer of 1977, a successful winter fishery was conducted in 1977-78 when the average subsistence catch

Table 2. Commercial harvest of red king crabs in Norton Sound,
summer fishery, 1977-1985.

Year	Legal male pop. est. 1/	Commercial harvest 3/	Number of vessels	Crab/ pot	Avg. wt.	Exvessel price	Fishery value millions \$
1976	2/4/ 8.1	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
1977	5/ 10.0	0.52	7	36	2.7	0.75	0.229
1978	5/ 11.0	2.09	8	64	3.0	0.95	1.897
1979	4/ 5.4	2.93	34	28	3.0	0.75	1.878
1980	6.6	1.19	9	29	3.6	0.75	0.890
1981	4.7	1.38	36	11	3.7	0.85	1.172
1982	1.3	0.23	11	6	3.6	2.00	0.405
1983	2.1	0.37	23	12	2.8	1.50	0.537
1984	2.7	0.39	8	14	2.8	1.02	0.395
1985	2.4	0.43	6	11	2.9	1.00	0.427

1/ Population estimate prior to fishery in given year in millions of pounds.

2/ No commercial fishery in 1976.

3/ Millions of pounds.

4/ Population estimate derived by National Marine Fisheries Service.

5/ Population estimate derived from catch per pot from commercial fishery.

was 84 crab and the average winter commercial catch was 260 legal sized crab. The winter fishery declined sharply the following year and remained at very depressed levels through the 1981-82 season.

The lack of success in the winter crab fishery during some past years has been attributed to a declining crab population caused by removal of crab in the summer commercial fishery together with low recruitment, low effort due to poor ice conditions, and changes in nearshore winter distribution of crab. All of these factors probably had some effect on the success of the winter fishery in varying degrees. During the 1978-79 winter fishery, the king crab population was still relatively high. Despite this relatively large population, winter catches were the poorest on record indicating that the major factors limiting winter catches during 1978-79 were probably poor ice conditions and the offshore distribution of crab. During the winter of 1981-82, poor winter catches could more reasonably be attributed to a declining crab population and commercial catch removals since the crab population was at its lowest documented level. Subsistence fishing success during the past three seasons, the winter of 1982-83 through 1984-85, has improved due to a rebuilding population and use of more efficient gear (pots instead of handlines) (Table 1).

During parts of the 1984-85 winter, ice conditions were very unstable. Many subsistence fishermen reported gear losses when the ice pack moved offshore several times during February and March. Ice conditions stabilized during an unusually cold April, with catches also reported during the month of May. Fishing effort during the 1984-85 season was the third highest on record with a total of 203 permits issued. Since the winter of 1983-84, the permits issued have been more detailed than past years, asking for the gear type used, the sex of the catch, the number of crab caught and the number of crab kept (Table 3). Permit information again showed that pots were by far the most commonly used gear type. Gear type information is not available from past permits; however, it has been observed that historically the major gear type was handlines. During the season of 1982-83, fishermen began to use pots more frequently. The total reported harvest for the winter of 1984-85 was 8,377 crab, 55 of which were female. A total of 2,058 male and 322 female crab were captured but released. This harvest was similar to the 1983-84 season harvest but below the record harvest set in 1977-1978 (Table 1). Again unstable ice conditions rather than a depressed population were most probably the cause of a slightly lower harvest when compared to the past two winters.

Table 3. Winter 1984-85 subsistence red king crab catches and effort by gear type, Norton Sound.

Gear type	# Fish-ermen	# Males Caught	# Males Kept	# Females Caught	# Females Kept	Total Crab Captured	Total Crab Kept	Average 1/ Harvest/fm
Pots	67	7490	5735	293	40	7783	5775	86
Handlines	37	1175	1109	35	9	1210	1118	30
Both	21	1674	1438	41	4	1715	1442	69
Unknown	7	41	40	8	2	49	42	6
Totals	132	10380	8322	377	55	10757	8377	63

1/ Harvest refers to crab that are kept.

Stock Status/Research

In 1976 when monitoring of the Norton Sound king crab population first began, the population was mainly composed of prerecruit and recruit crab (Table 4, Figure 4). This first population assessment survey by the NMFS estimated the legal male king crab population at 8.1 million pounds (Table 4). The legal male crab population peaked in 1978 at an estimated 11 million pounds. During the 4 years following 1978, recruitment into the legal male crab population was very low. Subsequent NMFS surveys in 1979 and 1982 documented a population of predominantly postrecruit crab, and estimated a decline in the population to 2.6 million pounds by 1982 (Table 4). The Department of Fish and Game conducted their first population assessment survey in 1980, with subsequent surveys in 1981 and 1982 (Figure 5). These survey assessments documented a similar decline of from 6.6 million pounds (1980) to 1.3 million pounds (1982). Beginning in 1981, sublegal crab abundance began to increase, and by 1983 recruitment into the legal male population also began to increase. No assessment work was conducted in 1983 or 1984. However, samples of the commercial catches indicated a significant increase of recruit crab into the legal male population; from an historic low of 10% in 1981 to 59% in 1984 (Table 5). The 1984 population was similar to the 1976 population in that it was composed of mainly sublegal and recruit crab, however, the 1984 population consisted of considerably fewer crab than the 1976 population.

In 1985 both NMFS and the Department conducted population assessment surveys in Norton Sound (Table 4, Figure 6). The Department fished 65 stations throughout Norton Sound capturing 4,645 legal males, of which one third were tagged. Subsequent recapture of tagged crab by the commercial fleet in August provided tag to untagged ratios, and the population prior to the fishery was estimated at 2.4 million pounds (Table 4).

Past research has shown that female crab 75mm and greater in carapace length will have egg clutches 99% of the time. A total of 185 female king crab were captured during the 1985 ADF&G pot survey. Of the 185 sampled, 144 were adult and 41 were juvenile. Ninety-three percent of the adult female king crab had egg clutches 80-100% full. The remaining seven percent had egg clutches 0-59% full. In addition, Department observers onboard four commercial fishing vessels sampled 2,845 adult and 864 juvenile female red king crab. Ninety-five percent of the adult female crab had egg clutches 80-100% full; five percent had 0-59% full clutches.

Table 4. Catch of red king crabs in Norton Sound during research surveys and resulting population estimates, 1976-1985.

King Crab Survey					# Crabs Captured 1/ Sub-legal Legal Fe- legal Males Males males			Avg. Le- gal Crab per Pot	Population Estimates Legal Males Numbers Pounds		Commercial Harvest Pounds Weight	
Date	Days	Agency	Vessel	Method								
1976 9/2-9/5 9/16-10/7	13	NMFS	Miller-Freeman	Trawling 150 tows	760	2/ 555	180	--	3,119,800	8,111,480	None	--
1979 7/26-8/5	11	NMFS	Miller-Freeman	Trawling 71 tows	46	3/ 194	40	--	837,241	2,511,723	2,931,672	3.0
1982 9/5-9/11	7	NMFS	Miller-Freeman	Trawling 50 tows	322	4/ 107	265	--	970,646	2,620,744	228,921	3.6
1985 9/16-10/1	16	NMFS	Argosy	Trawling 78 tows	226	3/ 163	151	--	1,203,000	3,369,000	427,011	2.9
1980 7/4-7/14	11	ADF&G	Altair	Pots-397	443	8/ 3,290	150	0	1,900,000	6,600,000	1,186,596	12/ 3.4
1981 6/28-7/14	17	ADF&G	Altair	Pots-718	4,097	8/ 3,415	1,933	5	1,285,195	4,755,221	1,379,014	3.7
1982 7/6-7/20	16	ADF&G	Aleutian #1	Pots-689	5,019	8/ 2,001	424	3	353,273	1,271,783	220,921	3.6
1985 7/1-7/14	14	ADF&G	Arctic Sea	Pots-642	6,086	8/ 4,645	13/ 185	7	907,579	2,414,644	427,011	2.9

- 1/ Number of crab captured on ADF&G surveys represents data standardized for a 24-hour soak period. these data are edited and finalized.
- 2/ Legal males include crab of 106 mm and greater carapace length.
- 3/ Legal males include crab of 105 mm and greater carapace length.
- 4/ Legal males include crab of 103 mm and greater carapace length. ADF&G research has shown 103 mm is the point where over 50% of the crab that length are of legal width.
- 5/ Estimate of crab immediately after the 1979 summer commercial fishery.
- 6/ Estimate of crab immediately after the 1982 summer commercial fishery. The molt was in progress during the survey so this estimate also includes some recruitment as well as the remaining legal crab.
- 7/ The poundage for the 970,646 estimated legal crab was derived by comparing the 1982 research average legal crab length of 113 mm to the 1977 commercial fishery which had a similar average length of 115 mm and an average weight of 2.7 pounds.
- 8/ Legal male crab captured on ADF&G research surveys are crab with carapace-width equal to or greater than 4 3/4 inches regardless of length.
- 9/ Estimate of crab immediately after 1985 summer commercial fishery. The molt was in progress during the survey; this estimate also includes some recruitment as well as the remaining legal size crab.
- 10/ ADF&G estimates are calculated using the Peterson mark and recapture methods. Estimates are for legal male crab prior to the summer commercial fishery.
- 11/ The 1980 estimate has been revised from the original estimate of 13.4 million pounds. The original estimate was inaccurate due to inadequate recovery of tagged crab.
- 12/ Obtained from actual samples taken aboard the catcher/processor, BILLIKIN.
- 13/ Preliminary data standardized for a 24 hour soak period.

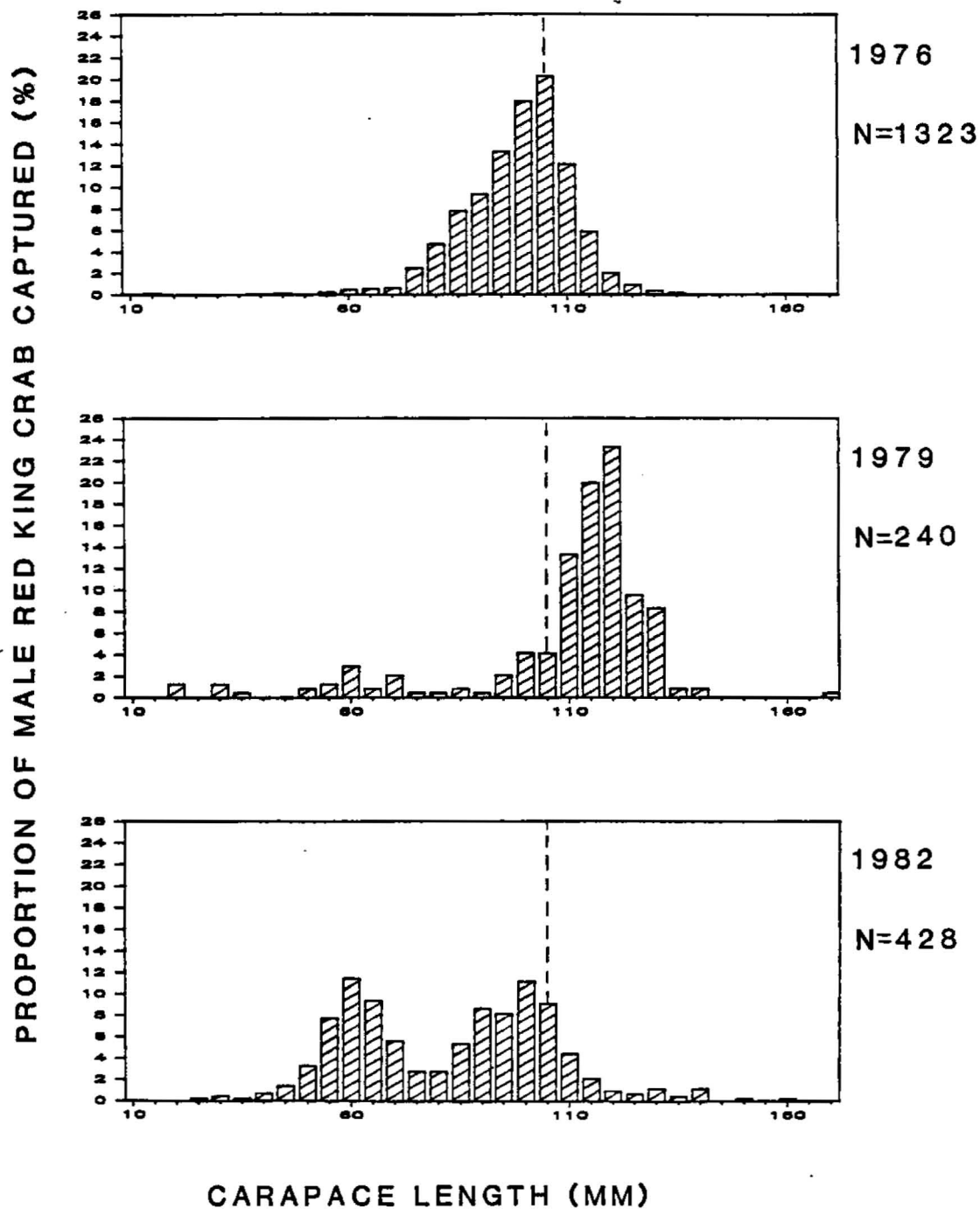


Figure 4. Size structure of the male red king crab population, Norton Sound, Alaska as determined by research fishing, NMFS. Dotted line represents present minimum legal size.

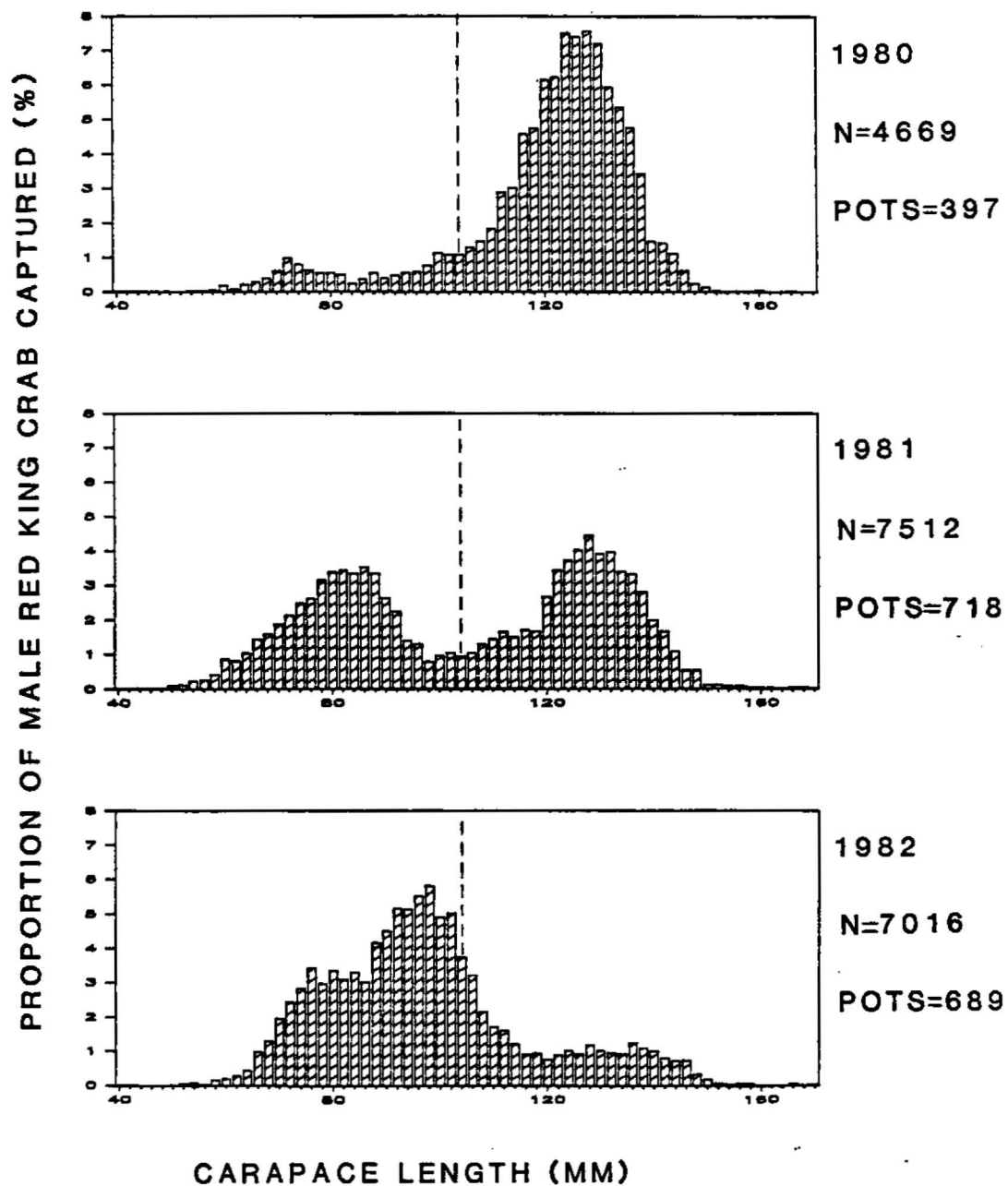


Figure 5. Size structure of the male red king crab population, Norton Sound, Alaska as determined by research fishing, ADF&G, 1980-1982. Dotted line represents present minimum legal size.

Table 5. Percent recruit size crab for the Norton Sound male red king crab population from commercial catch samples.

Length (MM)	Year								
Category 1/	77	78	79	80	81	82	83	84	85
Recruits	53	29	33	15	10	27	55	59	45
Postrecruits	47	71	67	85	90	73	45	41	55

1/ Recruits = All new shell legal size male crab of
carapace length <115mm.
Postrecruits = All other legal sized male king crab.

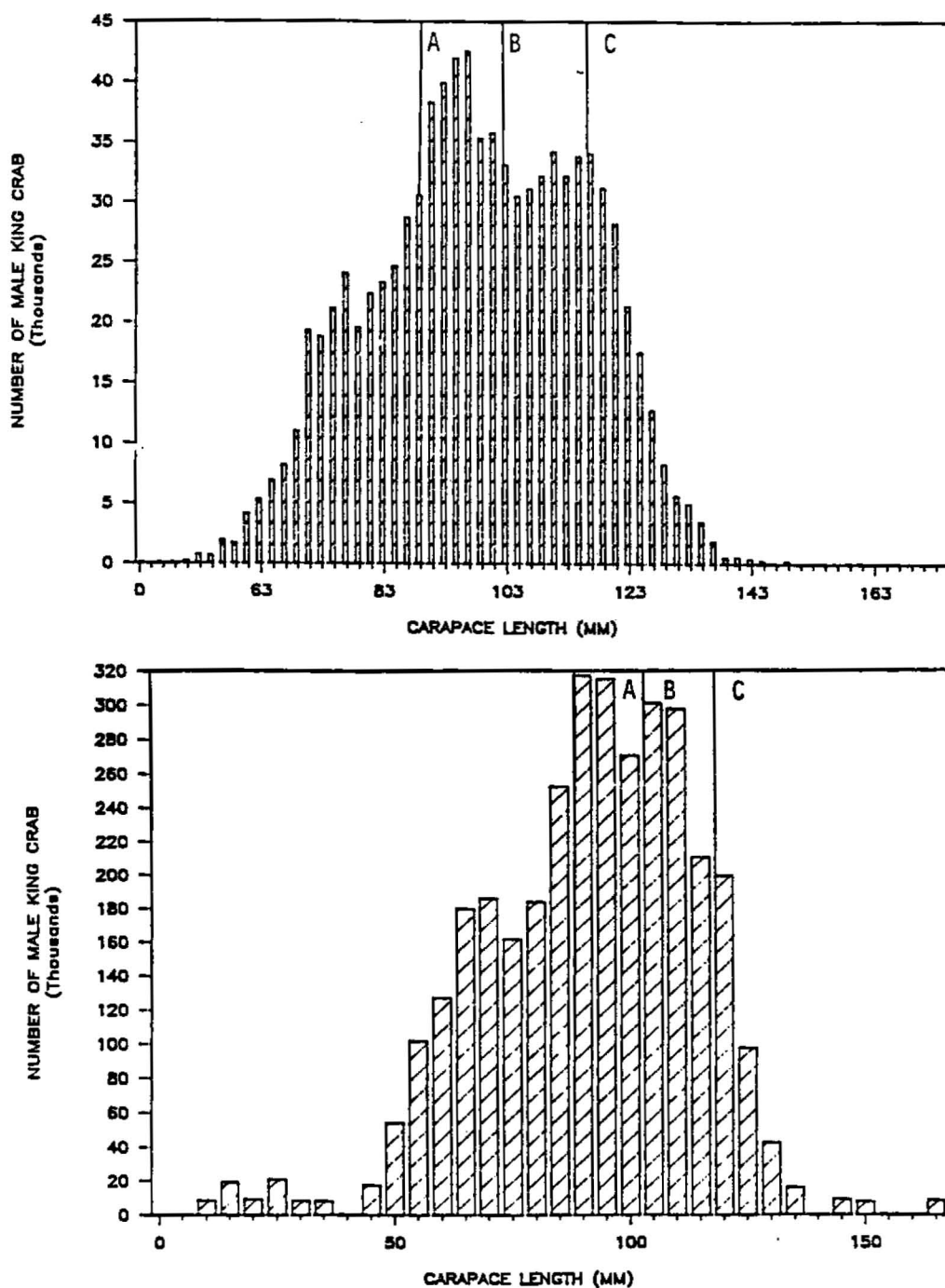


Figure 6. Size distribution of the 1985 Norton Sound male red king crab population from assessment surveys conducted by ADF&G (Top) and NMFS (Bottom). Portions of the graph labeled A are prerecruit one crab; B are recruit crab and C are postrecruit crab.

After the commercial fishery NMFS conducted a population assessment survey using trawl gear over a slightly larger area than that surveyed by the Department. Catches of male king crab by NMFS were in the process of or had just molted with the result being that their estimate of 3.4 million pounds of legal male king crab includes some recruitment. Adjusting this estimate for molting, and including the summer commercial harvest, the estimate becomes 3 million pounds present prior to the August fishery. Both surveys documented relatively substantial numbers of recruit crab and a healthy percentage of prerecruit crab, though at this level it will take some time to rebuild the stock (Figure 6).

From January 9 to May 3, 1985, the Department conducted winter crab studies through the ice. Crab pots were fished through the ice near Nome at the same locations, when ice conditions permitted, as in previous years. A total of 31 pots were pulled capturing 761 male and 12 female king crab. A total of 284 male crab were tagged and released. Preliminary data indicated an average length for male crab of 97 mm. Fishing was hampered by poor ice conditions throughout the season. Lack of ice and moving ice caused loss of gear, with periods of no fishing during most of February and March.

Although the total catch of 761 male crab was much lower than 1983 (2,586) and 1984 (1,677) the average catch per pot of 24 male crab was the same, indicating crab abundance comparable to the past two years. Ice conditions were more stable in 1983, allowing more fishing time and a larger catch.

Outlook for 1986

An estimated 2.8 million pounds of legal size male red king crab (Table 6) will be available prior to the August fishery in 1986. This was derived using the estimate of population size from the Department's 1985 assessment survey and allowing for the 1985 August commercial removal, growth through molting and one year's natural mortality. The stock is still considered to be in a depressed state with stable recruitment and a stable level of postrecruit size crab. A population of this size could support a harvest of 427,000 pounds, one half the level determined under 5AAC 34.080, or 15% exploitation.

Table 6. Population estimate for Norton Sound
male red king crab.

Male Red King Crab	1985		1986 Projection 1/	
	Number	Pounds	Number	Pounds

Sublegal				
Prerecruit	593,147	972,862		
Legal				
Recruit	470,335	1,066,293	484,648	1,118,326
Postrecruit	437,244	1,348,350	523,265	1,727,166
	-----	-----	-----	-----
Total	907,579	2,414,644	1,007,913	2,845,493

1/ A projection of the 1985 population estimate after
subtracting the commercial catch and allowing for
a molt and one year's natural mortality.

Management Strategy

Although significant recruitment into the legal population has occurred during each of the past 4 years (Figure 7), the legal male population is still considered to be depressed. The current outlook of 2.8 million pounds is considerably below the peak estimate of 11 million pounds in 1978. With the current recruitment and harvest levels, the population has been stable at between 2-3 million pounds for the past 3 years (Table 2). Since the population size is at a low level, and there is the requirement to provide for the subsistence fishery, the staff recommends that the conservative management initiated in 1983 and implemented in 1984 and 1985, be retained in 1986. This strategy has been incorporated in the regulation book and would set the O.Y. at 15% of the legal male population.

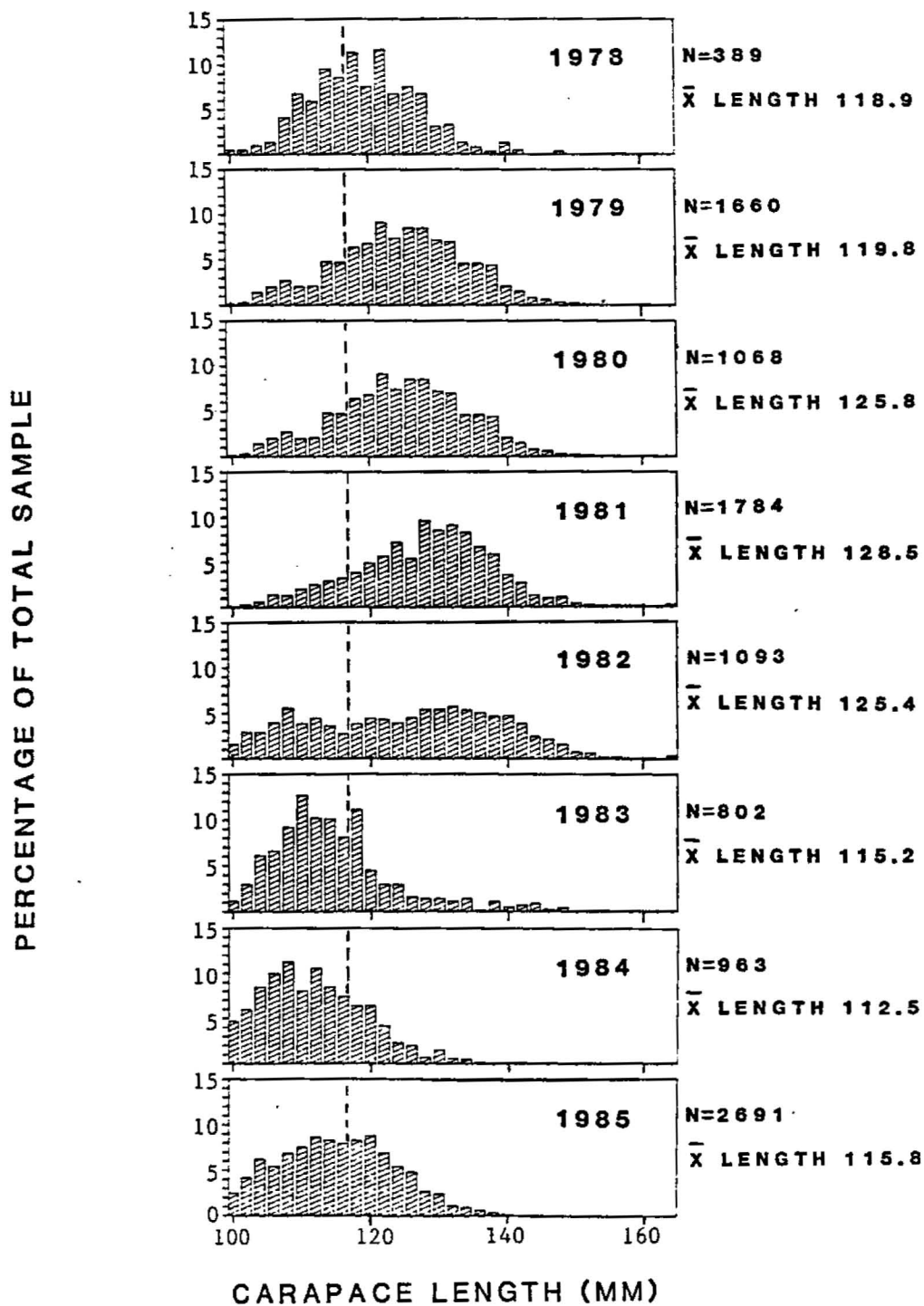


Figure 7. Red king crab catch samples for the Norton Sound summer fishery, 1978-1985. Crab to the left of dotted lines are recruits.